SECTION 16721: FIRE DETECTION, MNS AND ALARM SYSTEMS

PART 1 GENERAL

1.01 RELATED SPECIFICATION SECTIONS:

A. Section 01000 – GENERAL REQUIREMENTS

1.02 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Factory Mutual System (FM) Publication
      a) Approval Guide (Equipment, Materials, Services for Conservation of Property) 1989 with Quarterly Supplements.
   2. National Fire Protection Association (NFPA) Standards:
      a) NFPA 70 National Electrical Code.
      b) NFPA 72 National Fire Alarm Code.
      c) NFPA90A Installation of Air Conditioning and Ventilating System.
   3. Underwriters Laboratories, Inc. (UL) Publications:
      a) Fire Protection Equipment Directory (Jan 1989 with Quarterly Supplements).
      b) UL 38 Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
      c) UL 228 Door Closers-Holders, with or without Integral Smoke Detector.
      d) UL 268 Smoke Detectors for Fire Protective Signaling Systems.
      e) UL 268A Smoke Detectors for Duct Application
      f) UL 464 Audible Signal Appliances.
      g) UL 521 Heat Detectors for Fire Protective, Signaling Systems.
      h) UL 864 Control Units for Fire-Protective Signaling Systems.
   4. Unified Facility Criteria (UFC) 3-600-01, Design: Fire Protection Engineering for Facilities
   5. Unified Facility Criteria (UFC) 4-021-01 Design and O&M: Mass Notification Systems

1.03 SUBMITTALS

A. Submit shop drawings showing all system components under provisions of Section 01300.

B. Submit manufacturer's data on all components used in the system under provisions of Section 01300.

C. The authority having jurisdiction and the alarm shop 1 SOCES|CEOFA shall be notified prior to installation or alteration of equipment or wiring. Complete information regarding the system or system alterations, including specifications, type of system or service, shop drawings, input/output matrix, battery calculations, and notification appliance circuit voltage drop calculations shall be submitted for approval. Under no circumstances will installation begin prior to approval of SUBMITTALS.

D. Submit Qualification of Installer per PART 2, Paragraph 2.05.

1.04 SCOPE

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings. Only an addressable fire alarm system shall be accepted.

B. Basic Performance:
   1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 6 (Class A) Signaling Line Circuits (SLC).
   2. Initiation Device Circuits (IDC) shall be wired Class A as part of an addressable device connected by the SLC Circuit.
   3. Notification Appliance Circuits (NAC) shall be wired Class A as part of an addressable device connected by the SLC Circuit.
   4. On Style 6 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
   5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

C. Basic System Functional Operation
   1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
      a. The system alarm LED on the system display shall flash.
      b. A local piezo electric signal in the control panel shall sound.
      c. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
      d. The fire alarm strobe horns shall sound or if MNS, the clear strobe shall flash and the fire message shall be announced through the fire/mns speakers.
      e. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
      f. All system output programs assigned via control by event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

1.05 Operation

A. Activation of any automatic fire detection device or manual station shall result in the continuous operation of all fire audio/visual devices in the building, shutdown of air-handling units below 2000CFM, and activation of the radio transceiver for transmission of a radio signal to central monitor location. The fire alarm system shall be wired *and* all associated conduits shall be Class A in accordance with NFPA 72 ch.6.4.2.2.2. All suppression system shall activate a separate zone on the transceiver for off normal conditions and water flow. Flow switches and tamper shall not be on the same zone. Any alarm or trouble condition silenced at the panel shall not remove that condition from the radio transceiver inputs.

PART 2 MATERIALS AND EQUIPMENT

2.01 General Requirements

A. Materials and equipment shall be new standard products of the manufacturer's latest design, and suitable to perform the function intended. Components of two or more models will not be combined to form a single control unit. This equipment shall be in service for five years after the install date. Where two or more pieces of equipment must perform the same functions, the same manufacturer shall produce this equipment. The name of the manufacturer shall appear on all major components. Locks for all cabinets shall be keyed the same as the Monaco Radio Transceiver. (CORE NUMBER C415A). Fire alarm points shall be labeled by device type and location. There shall only be one central fire alarm panel located in any facility. Heat detectors and all associated conduit and wiring shall be removed from the facility when a fire sprinkler system is installed.

2.02 Quality Requirements

A. All materials and equipment shall conform to the requirements of the UL, or the FMS for fire-alarm systems of the type indicated. The Contractor shall submit proof that the items furnished under this specification conform to these requirements. The UL label or seal, or listing in the UL Fire Protection Equipment Directory will be accepted as evidence that the items conform to UL requirements. The FMS label or seal, or listing in the Factory Mutual Approval Guide will be accepted as sufficient evidence that the items conform to the FMS requirements.

2.03 Shop Drawing and System Designer Qualifications

A. Within 30 days after receipt of notice to proceed and prior to starting installation, the Contractor shall submit to the Contracting Officer for approval a complete set of shop drawings to include all material and equipment proposed for installation Sealed by a registered fire protection engineer, by a registered professional engineer having at least four years of current experience in the design of fire protection and detection systems, or by an engineering technologist qualified at NICET Level IV in fire systems. The individual's name, signature, and professional engineer number or NICET certification number shall be included on all final design documents. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point to point diagrams, and conduit layouts. Show annunciator layout, configurations, and terminations.

2.04 Spare-Parts Data

A. After submittal of the list of equipment, and no later than 2 months prior to contract scheduled completion, the Contractor shall furnish two copies of spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified below to be furnished as part of

the contract and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation.

2.05 Qualifications of Installer

A. System Installer: Installation personnel shall be qualified or shall be supervised by persons who are qualified in the installation, inspection, and testing of fire alarm systems. Evidence of qualifications or certification shall be provided when requested by the authority having jurisdiction. Qualified personnel shall include, but not be limited to, one or more of the following:
   1. Personnel who are factory trained and certified for fire alarm system installation of the specific type and brand of system being installed
   2. Personnel who are certified by a nationally recognized fire alarm certification organization acceptable to the authority having jurisdiction
   3. Personnel who are registered, licensed, or certified by a state or local authority.
      The Contracting Officer shall reject any proposed installer who cannot show evidence of such qualifications.

PART 3 EXECUTION

3.01 Pre-Construction Test

A. Prior to starting any work on existing systems the contractor shall schedule through the contracting office a fire alarm system pre-test to establish the baseline for the alarm system. Any discrepancies identified shall be signed off by the contractor, 1 SOCES Alarm Shop, and contracting officer or his/her representative. Failure to conduct this test will hold the contractor solely responsible for all discrepancies during final inspection.

3.02 Installation and Wiring

A. System components shall be securely fastened to their supports independently of the wiring. The control unit shall be installed in a room directly accessible from the building exterior. Runs of conduit, tubing, wire and cable shall be straight, neatly arranged, **properly supported**, painted red and parallel or perpendicular to walls and partitions. Installation of wiring shall conform to NFPA 70. NOTE: 300.11 Wiring located within the cavity of a non–fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. All wiring shall be installed in conduit (minimum ¾" EMT). The sum of the cross-sectional areas of individual conductors shall not exceed 40 percent of the interior cross-sectional area of the conduit. All wiring for the system shall be solid wires. The fire alarm system wiring shall not share the same conduit as other low voltage wiring, such as cameras, access control, etc. Wiring for audible visual circuits shall be color-coded red for positive and black for negative. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for Initiating Device Circuits and signaling Line Circuits, and 14 AWG for Notification Appliance circuits. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as Fire Alarm. Fire Alarm Control Panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded. All wire and cable shall be listed and/or approved by recognized testing agency for use with a protective signaling system. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. All field wiring shall be electrically supervised for open circuit and ground fault. Wiring for audible visual circuits shall be color-coded red for positive and black for negative. All conduit, junction boxes and their covers will be painted red. Existing wiring in facilities being renovated shall not be reused and must be removed.

B. Twist-on connectors (wire nuts) shall not be used. Connections shall be permitted to be made using a set-screw, pressure-type conductor connector, provided a means is used to prevent the set screw from bearing directly on the conductor.

C. Fire alarm circuits shall be identified by the use of red covers or doors. The words “fire alarm circuit” shall be clearly marked on all terminal and junction locations to prevent unintentional interference.

D. All circuits shall be installed CLASS A, wiring and conduit shall comply with NFPA 72 CH. 6.4.2.2.2.

E. All modules shall have their address clearly and permanently labeled on the outside of the devices.

F. All address modules shall be integrated with the device.

G. Fire circuits shall not be run in the same raceway, cable or conduit as high voltage circuits (120vac).

H. Fire alarm circuits derived from the fire alarm panel shall not be terminated on the same device with 120VAC power unless it is a relay designed for the use.

3.03 Audible and Visual Alarm Devices

A. Audible and Visual devices shall be furnished to indicate an alarm throughout the building. Devices shall be ceiling mounted unless waived in writing by the AHJ. All devices shall be supervised and operate on low voltage D.C. furnished by the control panel. All audible devices shall meet U 464

B. Where audible appliances are installed to provide signals for sleeping areas, they shall have a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds or a sound level of at least 75 dBA, whichever is greater, measured at the pillow level in the area required to be served by the system using the A-weighted scale (dBA).

C. If any barrier, such as a door, curtain, or retractable partition, is located between the notification appliance and the pillow, the sound pressure level shall be measured with the barrier placed between the appliance and the pillow.

D. If ceiling heights allows, and unless otherwise permitted all-mounted appliances shall have their tops above the finished floors at heights of not less than 2290 mm (80 in.) and below the finished ceilings at distances of not less than 150 mm (6 in.).

E. Ceiling-mounted or recessed appliances shall not be permitted.
Lights used for fire alarm signaling only or to signal the intent for complete evacuation shall be clear or nominal white and shall not exceed 1000 cd (effective intensity).

F. Lights used to signal occupants to seek information or instructions shall be amber.

G. Devices shall not be mixed.

H. Monitoring Integrity of Emergency Voice/Alarm Communications Systems.
Speaker Amplifier and Tone-Generating Equipment. If speakers are used to produce audible fire alarm signals, the required trouble signal for NFPA 72, Ch 4.4.7.2.1.1 through 4.4.7.2.1.3 shall be in accordance with 4.4.3.5. When primary power is available, failure of any audio amplifier shall result in a trouble signal. When an alarm is present and primary power is not available (i.e., system is operating from the secondary power source), failure of any audio amplifier shall result in a trouble signal.

I. All ceiling mounted devices shall be securely mounted in an approved box attached to the ceiling grid using a T bar and the ceiling tile shall have clips installed to prevent movement of tiles.

J. Any system installed where the audible devices are used for fire evacuation shall comply with all the requirements of 3.03 A-I and shall be tested for system integrity as a fire alarm system.

3.04 Mass Notification Systems

A. Mass Notification System Functions
1. Notification Appliance Network: The notification appliance network consists of audio speakers located to provide intelligible instructions at areas as indicated on the drawings.

2. Strobes: Strobes are also provided to alert hearing-impaired occupants. Provide amber colored strobes marked with the word “ALERT” to alert the hearing impaired. Install clear/white strobes for the building fire alarm system with the word “FIRE” to alert the user.
3. Voice Notification: An autonomous voice notification control unit is used to monitor and control the notification appliance network and provide consoles for local operation. Using a console, personnel in the building can initiate delivery of pre-recorded voice messages, provide live voice messages and instructions, and initiate visual strobe notification appliances.
4. Mass notification systems that are integrated with the building fire alarm system shall be consider a component of the fire alarm system and therefore shall meet all regiments of “Installed Fire Alarm Systems” subject to the AHJ and inspected as life safety equipment.
5. All power extenders, amplifiers, and control cabinets shall be protected in accordance with NFPA 72 Ch 4.4.5 (2007 Edition)
6. All audio circuits shall be install in accordance with UFC 4-021-01 chapter 4 (9 April 2008) Clear/white strobes activated by the fire alarm system shall not operate during those periods when the amber strobes are in operation, but otherwise shall operate continuously until the fire alarm system is reset.
7. Interface with the FACP to override fire alarm audible and visual notification appliances. The FACP shall provide supervised circuit integrity of interconnecting wiring between the MNS and FACP.
8. MNS shall temporarily override fire alarm audible messages and visual signals, and provide intelligible voice commands during simultaneous fire and terrorist events. All other features of the fire system, including the transmission of signals to the fire department, shall function properly. MNS messages shall take priority and continue to override fire alarm audible messages until the MNS message is either manually or automatically ended. If not manually ended, the MNS message will automatically end after 10 minutes.
9. Provide a supervisory signal if the MNS is used to override fire alarm audible messages and visible signals during simultaneous fire and terrorist events. The supervisory signal shall be at the FACP and any remote fire alarm annunciators, and be transmitted to the fire department. The visual annunciation of the separate supervisory signal shall be distinctly labeled or otherwise clearly identified.
10. The MNS shall not be used for PA or back ground music.
11. A Local Operating Console (LOC) shall be provided so that the travel distance to the nearest LOC will not be in excess of 61 m (200 ft) measured horizontally on the same floor. Have a single switch or operating mechanism capable of shutting down all HVAC equipment in the facility in accordance with the requirements of UFC 4-010-01.
12. AC fail on the MNS system (any component) shall generate a separate trouble to the BTX-M and transmit to the fire department.
13. No penetration will be made at the top of any control cabinet
14. The Monaco BTX-M radio shall be capable of receiving Live voice commands and activating the 8 pre-recorded messages from the Monaco D-21 located at Fire Department control room.

3.05 Mass Notification Control Panel

A. Provide a complete control panel fully enclosed in a lockable steel enclosure as specified herein. Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly. Control unit shall provide power, supervision, control, and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Control unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide secure operator console for initiating recorded messages, strobes and displays; and for delivering live voice messages. Provide capacity for at least eight pre-recorded messages. Provide the ability to automatically repeat pre-recorded messages. Provide a secure microphone for delivering live messages. Provide adequate discrete outputs to initiate/synchronize strobes. Provide a complete set of self-diagnostics for controller and appliance network. Provide local diagnostic information display and local diagnostic information and system event log file. Provide all necessary components to interface with fire alarm and detection system.

B. Cabinet: Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of panels as well as field wiring. No external wires to pass through cabinet. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "Mass Notification Control Panel" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in sturdy steel housing, complete with back

box, hinged steel door with cylinder lock, and surface mounting provisions. Mount the fire/mns panels at a height of 54 inches, measured from the floor.

C. Voice Notification System: The Voice Notification System shall comply with the requirements of NFPA 72 for Emergency Voice/Alarm Communications System requirements IEC 60849, IEC 60268, Part 16, except as specified herein. The system shall be a one-way multi-channel voice notification system incorporating user selectability of a minimum 8 distinct sounds for tone signaling, and the incorporation of a voice module for delivery of prerecorded messages. Textual audible appliances shall produce a slow whoop tone for three cycles followed by a voice message that is repeated until the control panel is reset or silenced. Automatic messages shall be broadcast through speakers on appropriate floor, but not in stairs or elevator cabs. A live voice message shall override the automatic audible output through use of a microphone input at the control panel or live voice transmitted from the fire department. When using the microphone, live messages shall be broadcast through speakers throughout the building. The system shall be capable of operating all speakers at the same time. **The live voice from the ALU shall be priority 1; live voice from the fire department is priority 2; and the live voice from the LOC shall be priority 3.** The digitalized voice message shall consist of a non-volatile (EPROM) microprocessor based input to the amplifiers. The microprocessor shall actively interrogate circuitry, field wiring, and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power, or any other malfunction that could render the digitalized voice module inoperative shall automatically cause the slow whoop tone to take over all functions assigned to the failed unit. Class "A" Notification Appliance Circuits (NAC) shall be provided for the activation of strobe appliances. The activation of the NAC Circuits shall follow the operation of the speaker NAC circuits. Audio output shall be selectable for line level (600 ohms), 25, 70.7 or 100 volt output. The audio amplifier outputs shall be not greater than 100 watts RMS output. The strobe NAC Circuits shall provide at least 2 amps of 24 VDC power to operate strobes and have the ability to synchronize all strobes. A hand held microphone shall be provided and, upon activation, shall take priority over any tone signal, recorded message while maintaining the strobe NAC Circuits activation. All outputs and operational modules shall be fully supervised with on-board diagnostics and trouble reporting circuits. Form "C" contacts shall be provided for system alarm and trouble conditions. Circuits shall be provided for operation of auxiliary appliance during trouble conditions. During a Mass Notification event the panel shall not generate nor cause any trouble alarms to be generated with the Fire Alarm system. Mass Notification functions shall take precedence over all other function performed by the Voice Notification System. PA system shall be deactivated during any fire/MNS messages. Messages shall be as follows:

Priority	Type	*Pre-tone	**Voice	Message Script (tones and messages repeat a minimum of three times)
1	Bomb Threat	Continuous	Male	May I have your attention please! A bomb threat has been reported in or around the building. Please follow the pre-plan and await further instructions.
2	Intruder	Continuous	Male	May I have your attention please! An intruder/hostile person has been sighted within or around the building. Please follow the pre-plan and await further instructions.
3	Alternate Exit	Continuous	Male	May I have your attention please! Please evacuate the building – using the designated alternate exits.
4	Fire	Code 3	Male	May I have your attention please! A fire emergency has been reported in the building. While this is being verified, please leave by the nearest exit and report to your designated assembly area.
5	Shelter In Place	Continuous	Male	May I have your attention please! Please shelter in place, and await further instructions.
6	Weather	none	Male	May I have your attention please! The National Weather Service has issued a severe weather warning for our area.
7	All Clear	none	Male	May I have your attention please! The building emergency has ended. An all clear has been given. Please resume normal activities
8	Test	none	Male	May I have your attention please! This is a test of the mass notification system, this is only a test.

1. 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on) "May I have your attention, please? May I have your attention, please? A fire has been reported that may affect your floor. Please walk to the nearest exit and evacuate the building." (Provide a 2 second pause.) "May I have your attention please, (repeat the message)".

2. 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on) "May I have your attention please? May I have your attention please? A fire emergency has been reported in the building. Please leave the building by the nearest exit or exit stairway. Do not use the elevators." (Provide a 2 second pause.) "May I have your attention please, (repeat the message)".

3. 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on) "Alert! This is the Mass Notification System. There is an emergency situation. DO NOT evacuate the building! Stay in your current location! Stay tuned for further instructions (repeat message 2 times)".
4. 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on) "Alert, this is the Mass Notification System. There is a chemical gas emergency. Turn off all HVAC equipment, seal all doors and windows with wet fabric, Don protective gear. DO NOT evacuate the building, Act now! Listen to the MNS system for further instructions (repeat message 2 times)".
5. 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on) "Alert, this is the Mass Notification System. There is an explosive blast risk along the South wall of your building. Quietly move towards the north side of the building, and exit from the north stairs. Move away from the building heading north to the north parking area (repeat message 2 times)".
    a. Auxiliary Input Module shall be designed to be an outboard expansion module to either expand the number of optional remote microphone stations, or allow a telephone interface.

D. Memory: Provide each control unit with non-volatile memory and logic for all functions. The use of long life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS, or EPROMS.

E. Field Programmability: Provide control units and control panels that are fully field programmable for control, initiation, notification, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer based equipment.

3.06 Notification Appliances

A. Mass Notification Speakers: Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted white. Recessed audible appliances shall be installed with a grill that is painted white with a factory finish to match the surface to which it is mounted.
1. Provide appliances capable of satisfying all Uniform Federal Accessibility Standards (UFAS) and Americans with Disability Act Accessibility Guidelines (ADAAG) Speakers shall conform to the applicable requirements of UL 1480. Speakers shall have six different sound output levels and operate with audio line input levels of 100 Vac, 70 Vac, 7 Vac, and 25 Vac, by means of selectable tap settings. Tap settings shall include taps of 1/4, 1/2, 1, and 2 watt. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 400Hz to 4000Hz, and shall have a sealed back construction. Speakers shall be capable of installation on standard 4 inch square electrical boxes. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring via the Voice Notification System.
2. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.
3. Provide speakers and installation methods compliant with Director of Central Intelligence Directive (DCID) 6/9 for areas classified as sensitive, compartmented information facilities (SCIF).
4. Verify intelligibility by measurement after installation. Ensure that a Common Intelligibility Scale (CIS) score greater than .8 is provided in each area where building occupants normally could be found.

Areas of the building provided with hard wall and ceiling surfaces (such as metal or concrete) that are found to cause excessive sound reflections may be permitted to have a CIS score less than .8 if approved by the DOD installation, and if building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 33 ft to find a location with a CIS score of at least .8. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than .8 if personnel can determine that a voice signal is being broadcast and they must walk no more than 50 ft to a location with a CIS score of at least .8. Measurements should be taken near the head level applicable for most personnel in the space under normal conditions (e.g., standing, sitting, sleeping, as appropriate). Commercially available test instruments shall be used to measure intelligibility as specified by IEC 60849 and IEC 60268-16. The mean value of at least three readings shall be used to compute the intelligibility score at each test location.

B. Visual Notification Appliances: Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Americans with Disabilities Act (ADA). Mass Notification Appliances shall have clear high intensity optic lens and xenon flash tubes. The clear optic lens shall have the special wording “FIRE”, the amber lens shall have the special wording “Alert”. The light pattern shall be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate shall be 1 flash per second and a minimum of 75 candelas based on the UL 1971 test. Strobe shall be ceiling-flush mounted. Where more than two appliances are located in the same room or corridor, provide synchronized operation.

3.07 Wiring

A. Provide wiring materials under this section as specified in Division 16 with the additions and modifications specified herein.

B. Alarm Wiring: The SLC wiring shall be copper cable in accordance with the manufacturer’s requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 16 AWG size conductors at a minimum. Notification appliance circuit conductors, that contain audible alarm devices, other than speakers, shall be solid copper No. 14 AWG size conductors at a minimum. Speaker circuits shall be copper No. 16 AWG size conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation.

3.08 LCD Alphanumeric Display

A. LCD Alphanumeric Display Annunciator:
   1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
   2. The LCD annunciator shall display all alarm and trouble conditions in the system.
   3. Up to 32 LCD annunciators may be connected to a EIA 485 interface. LCD annunciators shall not reduce the annunciation or point capacity of the system. Each LCD shall include vital system wide functions such as, System Acknowledge, Silence and Reset.
   4. LCD display annunciators shall mimic the main control panel 80 character display and shall not require special programming.
   5. The LCD annunciator shall have switches which may be programmed for System control such as, Global Acknowledge, Global Signal Silence and Global System Reset. These switch inputs shall be capable of being disabled permanently. Mount LCD annunciator at the main entrance to the facility.

3.09 Installation and Wiring

A. System components shall be securely fastened to their supports independently of the wiring. Runs of conduit, tubing, wire and cable shall be straight, neatly arranged, properly supported, and parallel or perpendicular to walls and partitions. Installation of all alarm wiring shall conform to NFPA 70. All wiring for the system shall be solid wires. All wiring shall be installed in conduit. All wire connections, etc., shall be within a box as specified in NFPA 70. The sum of the cross-sectional areas of individual conductors shall not exceed 40 percent of the interior cross-sectional area of the conduit. Wiring for alarm zones shall be color-coded by zone with two colors remaining consistent throughout the zone. No two zones using the same colors shall transit the same junction box. This does not negate the requirements for numbering wires. Numbers will originate at the control panel and be used throughout the circuit at all junctions and terminal devices. Wiring for audible visual circuits shall be color-coded red for positive and black for negative. All conduit, junction boxes and their covers will be painted red. Existing wiring and

conduit in facilities being renovated shall not be reused. Mount the fire alarm/mns panels at a height of 54 inches, measured from the floor.

3.10 Drawings and Manuals

A. Upon completion of the installation and prior to final inspection, the Contractor shall furnish two copies of "as-built" drawings. Drawings shall show equipment configuration, control panel equipment and subassembly locations, and the location of all connecting Wiring. Drawings shall include all wiring color codes and terminal numbers and termination points for all wires. In addition, the Contractor shall furnish two copies of a manual giving complete instructions for the operation, inspection, testing, and maintenance of the system including wiring diagrams. The drawings shall include a detailed wiring layout showing all junction boxes and all system wiring, including number of wires, with speaker and strobe circuits identified. The layout shall be done on the building floor plans and combined with fire detection and alarm system. See section 01700 CONTRACT CLOSE OUT.

3.11 Manual and Fire alarm Stations

A. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel operation, they cannot be restored to normal use except by the use of a key.

B. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

C. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear in the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

D. The operable part of each manual fire alarm box shall be not less than 1.1 m (3½ ft) and not more than 1.37 m (4½ ft) above floor level.

E. Manual fire alarm boxes shall be installed so that they are conspicuous, unobstructed, and accessible.

F. Manual fire alarm boxes shall be located within 1.5 m (5 ft) of the exit doorway opening at each exit on each floor.

G. Manual fire alarm boxes shall be mounted on both sides of grouped openings over 12.2m (40 ft) in width, and within 1.5 m (5 ft) of each side of the opening.

H. Additional manual fire alarm boxes shall be provided so that the travel distance to the nearest fire alarm box will not be in excess of 61 m (200 ft) measured horizontally on the same floor.

3.12 Fire-Detecting Equipment

A. Fire detecting equipment shall conform to NFPA 72 and shall be of the following types, as indicated on the drawings and as approved by the AHJ. All devices shall be addressable, no conventional devices allowed. Detector circuit design shall be suitable for the types and numbers of detectors, as approved, and shall limit detector circuit current not to exceed ratings of the detectors and associated relays. Smoke detectors shall not be installed or have protective cover removed until after the construction cleanup of all trades is complete and final. Furthermore, during renovation projects, existing detectors shall be removed and reinstalled or covered during construction.

B. Location: Detecting equipment shall be installed as shown on the drawings. Should a conflict occur between the drawings and the NFPA codes, the NFPA codes shall take precedence. Fire alarm components will not be installed on building exteriors unless expressly required by NFPA codes and then must be weather proof. Pull stations shall have removable plastic covers and be sealed around their mounting surface. Heat detectors shall be placed to provide total (complete) coverage as required in NFPA 72.

C. Photoelectric Type Smoke Detectors: Ceiling smoke detectors, which operate on the light scattering or the light obstruction principle, shall be furnished. In sleeping rooms, ceiling mounted smoke detectors shall be powered by DC circuits from the FACP, sound an audible alarm within the room only, does not activate or transmit signal to fire department and if removed from mount or disconnected, send a trouble signal with room location to the fire alarm panel to be transmitted to the fire department. AC powered detectors shall not be installed. Where combination heat smoke detectors are installed in sleeping areas, the smoke detector will operate as indicated above and the heat detector side shall announce a general

alarm throughout the facility and transmit and alarm signal to the fire department. Smoke detectors shall not be located in a direct airflow or closer than 3 feet from an air supply diffuser or return air opening.

D. Duct-Mounted Smoke Detectors: Duct-mounted photoelectric smoke detectors shall be furnished and installed in accordance with NFPA 72 and NFPA 90A. Sampling tubes of sufficient length shall be provided so that the sampling tube can be cut to exact length at the installation site to match duct width at the installed location and must be secured to the duct on both sides. A remote key/reset/test switch shall be furnished for duct detectors that are at a location that is not easily accessible for testing the installed duct detector. The detector housing shall be equipped with a transparent viewing port which shall permit viewing of detector head Alarm/Power-On indicator -at viewing angles up to 80 degrees off normal and inspection of cleanliness conditions inside the detector head mounting chamber. The detector shall be the plug-in type in which the detector base contains terminals for making all wiring connections. The detector indicator shall blink intermittently during standby conditions and shall glow red during alarm conditions. All LED's to indicate the operating and alarm condition and test and reset buttons or test part shall be visible, and accessible, with the unit installed and the cover in place. Detector operating voltage will be supplied from the DC circuits of the fire alarm panel.
   1. Air Handler Units (AHU) with a capacity below 2000CFM shall not have duct smoke detectors installed but shall be shut down from the fire alarm panel during an alarm activation. AHU's with a capacity between 2000 - 15,000 CFM shall have one duct detector installed in the supply air duct. AHU's with a capacity greater than 15,000 CFM will have two duct detectors installed, one in the supply air duct and one in the return air duct. Duct smoke detectors (2000 and larger) will shut down their respective AHU's upon activation and initiate a supervisory at the fire alarm panel. The fire panel shall activate a programmable relay to activate a zone to the Monaco Radio to acknowledge and send a supervisory signal from the duct smoke detector to the fire department.

E. Fixed-Temperature Heat Detectors: Only Addressable Fixed temperature heat detectors shall be installed. The UL 521 test rating shall be 135 degrees F. or as shown. Heat detectors installed in attics and mechanical rooms shall be rated at 194 degrees F only. Heat detectors installed in exterior applications such as open storage units shall be all weather detectors.

3.13 System Components Addressable Devices

A. Addressable Devices General
   1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
   2. Addressable devices, which use a binary coded address setting method, such as a DIP switch, are not an allowable substitute.
   3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
   4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
   5. The fire alarm control panel shall provide detector sensitivity adjustment through field programming of the system. The panel on a time of day basis shall automatically adjust sensitivity.
   6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
   7. The detectors shall be ceiling mount and shall include a separate twist lock base with tamper proof feature. Bases shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 6 applications. (Applies only to sleeping quarters)
   8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
   9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
   10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing

the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4inch square (101.6 mm square), 21/ 8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)
   1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
   2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
   3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector
   1. The detectors shall use the photoelectric (light scattering) principal to send data to the panel representing the analog level of smoke density.

D. Intelligent Laser Photo Smoke Detector
   1. The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
   2. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
   3. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.03 percent per foot.
   4. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
   5. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
   6. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
   7. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector
   1. The detectors shall use the dual chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector
   1. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine it's environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
   2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
   3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in

the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate of rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

I. Hostile Area Smoke Detector

1. The detector shall be designed to provide early warning smoke detection in environments where traditional smoke detectors are not practical.
2. The detector shall have a filter system to remove particles down to 25 microns.
3. This filter system shall remove unwanted airborne particles and water mist. This shall allow the detector to operate in environments where traditional smoke detectors would have nuisance alarms.
4. The filter system shall consist of 2 filters one of which is field replaceable.
5. The filter system shall have an intake fan to draw air and smoke through the filters into the sensing chamber.
6. The filter system shall be supervised so that if the filter is clogged or the fan fails the control panel reports trouble.
7. The filter system shall be powered from 24 VDC separate from the SLC communications.
8. The detector shall utilize a photoelectric sensing chamber.

J. Water-flow Indicator:

1. Water-flow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Water-flow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 to 45 seconds.
3. All water-flow switches shall come from a single manufacturer and series.
4. Water-flow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate water-flow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.
6. Water flow indicator shall be wired to an addressable monitoring module

K. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be secured with a chain and lock.
3. Valve supervisory switches shall be provided and connected as separate addressable points to the fire alarm system.

L. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Class A operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 23/4 inch (70 mm) x 11/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

M. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone shall be wired for Class A operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

N. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Class A signal operation.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

O. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to same time on the same pair of wires.

3.14 Suppression Systems

A. Control Valve Supervisory Signal-Initiating Device.

1. Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position (off-normal) and the other indicating restoration of the valve to its normal position. The off-normal signal shall be initiated during the first two revolutions of the wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.
   The off-normal signal shall not be restored at any valve position except normal.
   Initiating device for supervising the position of a control valve shall not interfere with the operations of the valve, obstruct the view of its indicator, or prevent access for valve maintenance.
2. Control valve supervisor signals shall be sent to the fire station as a separate supervisor signal via Monaco BTX-M radio transceiver.
3. Fire pumps are required to be monitored. Individual supervisory signals shall be provided for the following conditions:
   a. Fire pump running
   b. Fire pump loss of power in any phase
   c. Fire pump phase reversal
   d. Activation of a fire pump supervisory signal shall initiate a supervisory alarm at the system control panel and at the remote annunciators. Each set of contacts in the fire pump controller shall have address. All fire pump supervisory signals shall be transmitted to Fire Department VIA the BTX-M radio as a supervisory signal.

B. RELEASING SYSTEMS: Testing personnel shall be qualified and experienced in the specific arrangement and operation of a suppression system(s) and a releasing function(s) and shall be cognizant of the hazards associated with inadvertent system discharge. Testing shall include verification that the releasing circuits and components energized or actuated by the fire alarm system are electrically supervised and operate as intended on alarm.

E. A complete system discharge including releasing of suppression agent activated from the overhead riser shall be required on all new systems and any system that is modified in any way.
Suppression systems and releasing components shall be returned to their functional operating condition upon completion of system testing.

D. Water/Electric gongs shall not be required.

3.15 Kitchen Hood Suppression System

A. Kitchen hood suppression system shall not be installed in a manner that a loss of power would generate an alarm however; a trouble single would be required. A complete system discharge including releasing of suppression agent activated from the overhead riser shall be required on all new systems and any system that is modified in any way.

3.16 Access Control

A. Access control shall comply with Life Safety Code 101 para 7.2.1.5.2. Any device or system intended to actuate the locking or unlocking of exits shall be connected to the fire alarm system serving the protected premises. All exits connected in accordance with NFPA 72 ch 6.16.7.1 shall unlock upon receipt of any fire alarm signal by means of the fire alarm system serving the protected premises. Exception: Where otherwise required or permitted by the authority having jurisdiction or other codes. For all exits connected in accordance with NFPA 72 ch 6.16.7.1 and where batteries are used in accordance with NFPA 72 ch 4.4.1.5.1(1) as the secondary power supply, the batteries shall not be utilized to maintain these doors in the locked condition unless the fire alarm control unit is arranged with circuitry and sufficient secondary power to ensure the exits will unlock within 10 minutes of loss of primary power. Locks powered by independent power supplies dedicated to lock power and access control functions and which unlock upon loss of power shall not be required to comply with 6.16.7.3. **I**f exit doors are unlocked by the fire alarm system, the unlocking function shall occur prior to or concurrent with activation of any public-mode notification appliances in the area(s) served by the normally locked exits. All doors that are required to be unlocked by the fire alarm system in accordance with NFPA 72 ch 6.16.7.1 through 6.16.7.5 shall remain unlocked until the fire alarm condition is manually reset.

3.17 CONTROL UNIT

A. Control unit (Fire alarm panel) shall be addressable and be fully field programmable from the internal keyboard unless waived by the AHJ in writing. This shall include the addition of points, modification of points, and deletions. **ALL** system software required to perform uploads/downloads by base maintenance personnel shall be supplied. This includes the program for the facility system as well as the software and computer key that the laptop computer must use to perform these functions. Any connecting cables required to interface the laptop with the FACP shall be supplied. Installed as part of the system in each protected building and shall be approved for use with the fire detecting equipment, manual fire-alarm stations, and alarm-sounding devices. The unit shall operate with 24 volts DC derived from its internal AC rectifier/power supply. The control unit circuits shall be exclusively solid state. The control unit shall be housed in a substantial steel cabinet with lock and key. The cabinet shall be painted inside and out. The control unit shall include light emitting diodes (LED's)(Lamps or neon tubes not acceptable) to visually indicate the system condition, e.g., alarm and trouble by zone, system trouble conditions, primary and backup power supply status, etc. A single switch will be provided to test all LED'S. The control unit shall include a means to test all control unit functions. This includes a system test switch, zone disable, system reset, auxiliary disconnect and audible trouble silence switch, etc. The silence switch shall be provided with an audible resound feature. The unit shall supervise all alarm initiating circuits and all alarm sounding circuits. It shall also provide regulated and unregulated DC power for smoke detectors, which do not operate on zone voltage.. With a point disabled the control unit shall repeat the alarm sequence when a second, third, etc., alarm is initiated on other zones. All LED's shall be plainly visible when the door on the control unit is closed. The control unit shall operate separate audible and visual signals when a ground fault is detected in any supervised circuit or device. It shall sound a distinct audible alarm and activate the notification appliance circuit throughout the building when any manual or automatic device on the system is activated. The fire alarm panel shall be equipped with at least two alarm relays and one trouble relay as integral components of the panel. Add on relays are not acceptable. One alarm relay and the trouble relay dry contacts shall be used solely to activate a radio transceiver, Monaco *BTX_M.* The second alarm relay shall accomplish all auxiliary control, interlock and shutdown functions, as indicated herein and as shown on the drawings. Only low voltage (24) will be brought into the panel for auxiliary functions. The use of plug-on units and special devices not supplied by the manufacturer in conjunction with this feature is unacceptable. The control unit shall meet the requirements of UL 864 and shall be listed for NFPA 72.

B. A separate supervisory module will be provided for tamper and supervisory circuits.

C. Main FACP or network node shall be a NOTIFIER Model NFS2640 or equal and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

D. Water-flow Operation
An alarm from a water-flow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.

E. Operator Control
1. Acknowledge Switch:
   a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:
   a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto silence timers.

F. Alarm Activate (Drill) Switch:
1. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

G. System Reset Switch:
1. Activation of the System Reset switch shall cause all electronically latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

H. Lamp Test:
1. The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

I. System Capacity and General Operation
1. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
2. The control panel or each network node shall include Form C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
3. It shall also include two Class A (NFPA Style Z) programmable Notification Appliance Circuits.
4. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
5. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
6. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
7. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
8. The FACP or each network node shall provide the following features:
   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 5.
   c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
e. The ability to display or print system reports.
f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
g. PAS pre-signal, meeting NFPA 72 6.8.1.3 requirements.
h. Periodic detector test, conducted automatically by the software.
i. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
j. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
k. Walk test, with a check for two detectors set to same address.
l. Control by time for non-fire operations, with holiday schedules.
m. Day/night automatic adjustment of detector sensitivity.
n. Device blink control for sleeping areas.

9. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal, and California Code. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse." Notification Appliances shall meet the requirements specified in chapter 7 of NFPA 72.

J. Remote LCD annunciator's will be required. Exact numbers and location will be determined by design and approved by the AHJ. The location of an operated initiating device shall be annunciated by visible mean and at location accessible to first responders. Visible annunciation shall be by an alphanumeric display. The visible annunciation of the location of operated initiating devices shall not be canceled by the means used to deactivate alarm notification appliances.

D. Protection of Fire Alarm System. In areas that are not continuously occupied, automatic smoke detection shall be provided at the location of each fire alarm control unit(s), notification appliance circuit power extenders, and supervising station transmitting equipment to provide notification of fire at that location. Exception No. 2: Fully sprinkled buildings shall not require protection in accordance with NFPA 72 ch 4.4.5.

E. Audible Trouble Signal Silencing Means. The panel shall not utilize a key function to control unauthorized access to the panel.

F. No penetration will be made at the top of any control cabinet.

3.18 TRANSCEIVERS

A. Radio transceiver shall be provided for interface of the building fire alarm system and the existing Base central monitor receiver.
B. The transceiver required is a Building Transceiver BTX-M with a minimum of one transceiver, one relay board and one audio board manufactured by Monaco Enterprises, Inc.

C. Wiring used to interface the transceiver alarm and trouble Inputs with the fire alarm control panel shall be no greater in size than 18 AWG. Mount the radio at a height of 54 inches, measured from the floor.

D. The frequency of operation for the transceiver shall be 163.5375 MHz.

E. Zone one shall be alarm/trouble, zone two shall be sprinkler Flow and zone three sprinkler tamper Other features will be zoned into the transceiver as required by design.

F. No penetration will be made at the top of any control cabinet.

3.19 ANTENNA

A. Antenna: Antenna for radio transceiver shall be Monaco Assembly Part No. 190-400-00. Antenna shall be installed in accordance with manufacturer's instructions. Contractor shall provide a radio frequency (RF)

power meter to test and verify that the standing wave ratio (SWR) is within the manufacturer's specifications. Lightning arrestor kit shall be Monaco Assembly Part No. 190-007-01.

B. Contractor shall provide a radio frequency (RF) power meter to test and verify that the standing wave ratio (SWR) is within the manufacturer's specifications.

C. Mass Notification System equipment that communicates via radio shall be provided with an antenna system consisting of an antenna, a coaxial static discharge unit, and an antenna grounding system. The antennas shall be omnidirectional or directional, as appropriate, minimum 3dB gain, vertically polarized and shall be provided with all necessary mounting brackets and supports for installation. The antennas shall be installed with a 36-inch minimum vertical separation from the installed unit and shall be located well away from overhead power circuits. Antennas shall be installed and grounded in accordance with the applicable portions of NFPA 70. Antenna supporting structures shall comply with applicable portions of EIA 222-E. Antennas for remote transceivers shall be vertically polarized with a driving point impedance of 50 ohms. All antennas shall be installed external to buildings and shall be located in accordance with manufacturer recommendations.

D. Antenna Frequency Requirement: Antennas shall be adjusted or designed to operate on the specified radio frequency of 163.5375 MHZ.

E. Environmental Requirements: All complete antenna assemblies shall be of corrosion-resistant materials and designed for reliable operation under adverse conditions including 100-mph winds, ice, snow, and rain.

F. Antenna Cables: Coaxial cables shall be 50 ohm RG type (or equivalent) with minimum 95% shield and shall include PL and BNC type fittings or connectors as appropriate. Antenna cable for transmitter shall be RG-8/AU coaxial cable if length is greater than 20 feet. If length is less than 20 feet then use RG-58/AU. Utilize proper fittings or connectors with center conductors soldered to connector pins. Pressure type connectors are not acceptable. Protect exterior entry points against moisture. The manufacturer as requested by the contractor shall cut Cables to length unless the required length is within 5 feet of a standard cable length. Cables is excess of 5 feet of the required length are not acceptable. The antenna cable shall be installed in aluminum Conduit from radio to base of antenna with no cables exposed.

G. Grounding of Antenna Systems: Antenna masts and static discharge unit ground terminals shall be grounded in accordance with the requirements of NFPA 70, Article 810-21 and the manufacturer's instructions. Static discharge units and their enclosures shall be located inside the buildings as close as practical to the antenna lead-in point of entry. Ground rods shall not be used except where a suitable grounding electrode system does not exist. Where used, ground rods shall be of copper-clad steel conforming to UL 4561 not less than 5/8 inch in diameter by ten feet in length. Ground rods shall not protrude more than six inches above grade. Non-current-carrying metallic parts associated with mass notification equipment shall have maximum resistance to solid earth ground not to exceed the following values: Antennas/static discharge units 10 ohms; Radio alarm transceivers 10 ohms

3.20 Power Supply

A. Primary Power Supply: Primary power supply for the control unit shall be on a dedicated 15-amp branch circuit protected by surge protection devices the circuit breaker shall be protected from operation by unauthorized personnel by a circuit breaker guard. At locations where the circuit breaker is out of sight of the fire alarm control panel, a disconnect switch shall be installed adjacent to the control panel and clearly marked "FIRE ALARM". The conductors feeding the control panel shall be #12 AWG. Stake-on terminal lugs are not acceptable for wire terminations. Id tag will be rigid plastic. Primary power supply wiring shall be installed in electrical metallic tubing in accordance with the applicable requirements of the NEC 70.

B. Standby Power Supply: Standby power to insure operation of the fire alarm system in the event of primary power failure shall be provided by no more than two each maintenance free storage batteries. Power supply shall be provided with an automatic battery charger capable of a high/low charge rate. Battery shall have the capacity to operate the fire system for 24 hours and then be capable of sounding all alarms for five minutes for horn/strobe and 60 minutes for MNS voice evacuation under maximum load in the event of total failure of the primary power supply. The charging circuit for the battery shall be supervised to indicate a low battery condition and be rated to recharge fully discharged batteries in 24 hours.

3.21 Fire Department Equipment

A. The Contractor shall furnish transceiver that will interface, and be fully compatible with the Government system installed at fire department. The existing system is a Monaco D21-M Radio Fire ALARM System.

B. Contractor shall supply and install signage display the building number meeting base specification.

3.22 Drawing and Manuals

A. Upon completion of the installation and prior to final inspection, the Contractor shall furnish two copies of "as-built" drawings. Drawings shall show equipment configuration, control panel equipment and subassembly locations, and the location of the transceiver and all connecting Wiring. Drawings shall include all wiring color codes and terminal numbers and termination points for all wires. In addition, the Contractor shall furnish two copies of a manual giving complete instructions for the operation, inspection, testing, and maintenance of the system including wiring diagrams. The drawings shall include a detailed wiring layout showing all junction boxes and all system wiring, including number of wires, with zones and alarm sounding circuits and initiating and alarm sounding devices identified. The layout shall be done on the building floor plans. *The final inspection cannot take place without the drawings.*

3.23 Special Tools

A. All special tools or equipment necessary for the operation and maintenance of the equipment including testing shall be furnished. The items furnished will be new/ unused items with packaging and manuals.

3.24 Repair of Existing Work

A. The work shall be carefully laid out in advance. Cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings or other surfaces as necessary for the proper installation, support, or anchorage of the conduit or other work shall be carefully done. Damage to buildings, piping or equipment shall be repaired and refinished by skilled mechanics of the trades involved.

3.25 Tests

A. After all equipment for this system has been installed and made operational, and at a time directed by the Contracting Office, the contractor shall conduct tests to demonstrate that the installation and the system operation is in accordance with the plans and specifications. Testing of the system shall include remote annunciation of alarms and trouble conditions to the fire department. In addition to the request letter, the Contractor shall submit a test plan/procedure to the Contracting Officer to indicate his proposed method to demonstrate compliance with the plans and specifications. The contractor will also certify in writing that the work accomplished meets all contractual requirements. The government will provide one retest. Subsequent testing will result in reimbursement of expenses to the Government. Satisfactory operation of each of the following devices shall be demonstrated during the test:
   1) Each automatic detector.
   2) Each manual fire alarm station.
   3) Each transceiver, all functions.
   4) Each audible alarm device.
   5) Each visual alarm device.
   6) Supervision of each device such as; heat detectors, pull stations, smoke detectors, etc; and alarm zone circuits to include ground faults.
   7) Satisfactory operation after loss of primary power supply.
   8) Satisfactory operation of each device shut down circuit with correct zone correspondence. This shall not be simulated but shall actually be demonstrated by actual device/equipment shutdown.
   9) All control panel functions, alarm and trouble, audible and visual indicators, silence switches and their resound function and alarm resound features of the control unit.
   10) In each zone containing automatic smoke detectors, each detector will be put into the alarm mode and stay in that mode for 1 0 minutes after the last detector goes into alarm, to verify satisfactory operation of the detectors and the detector power supply module under alarm load. Smoke is expressly forbidden for this test.
   11) Supervision of DC power on each automatic detector circuit.

B. Documentation Required. Every system shall include the following documentation, which shall be delivered to the contracting officer two weeks prior to any initial inspections the system:
   1. An owner’s manual and manufacturer's published instructions covering all system equipment. Provide all manuals, drawings, technical/programming manual on a DVD disk.
   2. Record drawings
   3. For software-based systems, provide programming software, database, dongle key and computer cable to connect to fire panel.

3.26 TRAINING

A. All training will be accomplished by the manufacturer of the equipment installed not by the Installing company. The Contracting Officer will approve all training dates and times. All training will be done within 90 days of final acceptance of the fire alarm system. Equipment manufacturer shall provide 1 day on site training for the fire department and maintenance personnel and 5 days of technical training to the Government at the manufacturing facility. Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. The contractor shall furnish all literature, materials and training aids. Room and board costs shall be included for two Government personnel. Factory training shall occur within 3 months of system acceptance. The training days will be Monday through Friday between 0700 and 1500.

3.27 Quality Control

A. The Contractor shall establish and maintain quality control for operations under the section to assure compliance with contract requirements, and maintain records of his quality control for all materials, equipment, and construction operations, including but not limited to the following:
   1. Preparatory Inspection: (To be conducted prior to commencing work.)
   2. Submittal of all materials and shop drawings necessary for accomplishment.
   3. Have in hand equipment and wiring layout-showing sequence of wiring.
   4. Qualifications of installing firm.

B. Initial inspection: (To be conducted after a representative sample of the work is complete.)
   1. Check mounting heights, supports, accessibility of all items.
   2. Check temperature ratings of detection against ceiling temperatures anticipated at detector locations.
   3. Check size of conduit, boxes, and wires for proper sizing in accordance with National Electrical Code and Contracts.

C. Follow-Up Inspection: (to be conducted daily to assure compliance with results of initial inspection.)
   1. Determine that noted deficiencies are corrected.
   2. Make corrections for "as-built" fire alarm system drawings.
   3. Determine that all installed equipment is functional and in accordance with the contract requirement.
   4. Operational test performed.
   5. Damages or defects corrected.

   A copy of these records and Contractor tests as well as records of corrective action taken, shall be furnished the government as directed by the contracting officer.

3.28 Final Inspection

A. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

END OF SECTION